

Title

[Hikari disuku oyobi hikari disuku kudo sohchi]

Author Masatatsu Shiga

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D.C.
December 2004

Translated by: Schreiber Translations, Inc.

Country : Japan

Document No. : P2000-195060

Document Type : laid open patent

Language : Japanese

Inventor : Ikuo Aoki

Applicant : Samsung Inc. Yokohama Lab

IPC : Japan Patent Office

Application Date : December 28, 1998

Publication Date : July 14, 2000

Foreign Language Title: Hikari disuku oyobi hikari disuku kudo
sohchi]

English Title : An optical disk and An optical disk
drive device

(57) [Abstract]

[Topic]

It provides the optical disk suitable for handling a large capacity data of images and sound data etc with the physical format which easily secures the mutual exchangeability with an optical disk specializing in reproduction.

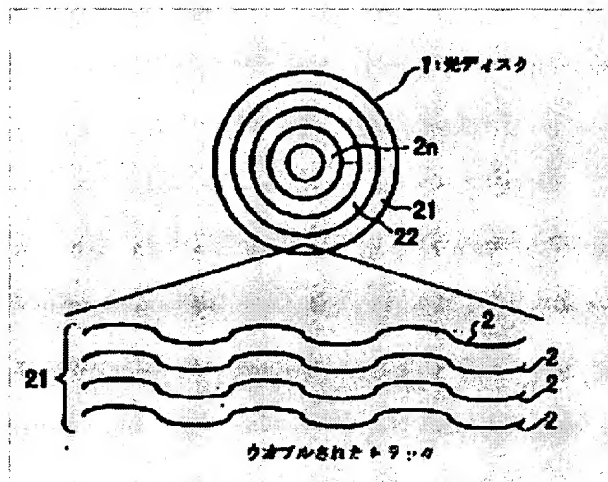


Figure shows wobbled track. See figure 1 in the back

[Solution steps]

An optical disk 1 is a rewrite type optical disk such as phase change medium or MO medium or write once type optical disk such as pigment type medium, and it is formed such that as the configuration of physical format of these optical disks, track 2 is partitioned into multiple zones 21 ~ 2n in the radius direction of an optical disk 1, and track 2 that is used to

record data snakes around in an optional fixed cycled wobble(s) which has different setting for each zone that is partitioned as described previously in the radius direction of an optical disk 1.

[The scope of patent claim]

[Claim 1]

Regarding the optical disks such as rewrite type disk that is MO medium or phase change medium equipped with spiral shaped tracks in order to record the information or reproduce the recorded information, or postscript type optical disk etc such as pigment type medium, it is the optical disk with the characteristics wherein aforementioned track is partitioned into plural number of zones in the direction of radius of aforementioned optical disk, and the tracks used to record the data is formed by wobbles with an optional fixed cycle that has different settings for each zone that are partitioned, as previously described, in the radius direction of aforementioned optical disk.

[Claim 2]

It is the optical disk described in the claim 1 with the characteristics wherein it is formed such that at least in each zone, aforementioned wobble is formed under the condition subjected to rotation control by the CAV (constant angular velocity) method and aforementioned wobble phases among the

aforementioned adjoining tracks themselves approximately match.

[Claim 3]

It is an optical disk drive device with the characteristics of being equipped with drive means that drives by rotation the above described optical disk in either one of claim 1 or claim 2, rotation control means that controls the aforementioned drive means to enable the rotation of aforementioned optical disk by an optional fixed rotation number, frequency detection means that detects the frequency of wobble signals generated based on the wobble frequency formed by the fixed cycle that are different for each zone of aforementioned optical disk, and address detection means that detects the address that specifies the aforementioned zone based on the frequency of wobble signals that were detected by aforementioned frequency detection means.

[Claim 4]

It is the optical disk drive device with the characteristics of being equipped with the drive means that drives by rotation the optical disk described in either one of claim 1 or claim 2, frequency detection means that detects the frequency of wobble signals generated based on the wobble frequency formed by the fixed cycle that are different for each zone of aforementioned optical disk, rotation number detection means that detects the rotation number of aforementioned drive means, rotation control means that controls the aforementioned drive means to enable the

synchronization of aforementioned optical disk with frequency of
aforementioned wobble signals based on the detection output of
aforementioned frequency detection means, and address detection
means that detects the address that specifies the aforementioned
zone based on the rotation number of drive means that was
detected by aforementioned rotation number detection means.

[Claim 5]

It is the optical disk described in either one of claim 1 or
claim 2 with the characteristics wherein at the time of recording
data, in the recording area at the head of aforementioned each
zone, address information that specifies the each zone is
recorded.

[Claim 6]

It is the optical disk described in either one of the claim of 1,
2 or 5 with the characteristics wherein the minimum unit of file
management of recording data has the physical format of
aforementioned zone unit.

[Detailed explanation of the invention]

[0001]

[Technical fields where the invention belongs to]

This invention relates to the optical disk such as rewrite type

optical disk that uses phase change medium or MO (photo electro magnetic) medium etc, or postscript type (write once) optical disk etc using pigment type medium, and the optical disk drive device.

[0002]

[Prior arts]

As the large capacity recording medium vis-à-vis computers, DVD (digital video disk) has been commercialized. Regarding an optical disk used for DVD, there are rewrite type optical disk and postscript (write once) type optical disk wherein rewrite type optical disk uses MO medium or phase change medium that enables the writing of data by users such as DVD-RAM(this memory enables read and write at any time) and DVD-ROM (memory specializing in read) that read the data stored in advance by users, and postscript (write once) type optical disk uses the pigment medium that enables the writing one time. Figure 6 shows the configuration of traditional optical disk specializing in reproduction (DVD-Rom). Same figure shows the traditional optical disk 50 specializing in reproduction wherein prebit rows are formed. Data recording area 52 of an optical disk 50 in the same figure (A) is amplified, and as shown in figure 6 (B), prebit rows are arranged in straight lines in the circumference direction of an optical disk 50.

[0003]

Figure 7 shows the physical format of the traditional optical disk specializing in reproduction where prebit rows are arranged as above. As to this physical format, the minimum unit of file management is one frame (sector), and if each frame shows sector address at its head as the address information, it consist of the data part (DATA) where data is written contiguous to this ID part, and these frames are formed continuously as prebit rows covering the entire circumference of an optical disk 50 (figure 6).

[004]

[The topic this invention attempts to solve]

However, the physical format in the memory area in DVD-ROM and DVD-RAM previously mentioned are different regarding the points shown below in the following examples. Regarding DVD-RAM, in order to manage the unallocated space, ID part (identification) showing the sector address is preformatted at the head of each sector. Regarding DVD-RAM, in order to store data in both of land track and group track, these ID parts are arranged in zigzag shape.

[0005]

As described above, regarding DVD-RAM, it is necessary to manage the memory area in order to rewrite data, this management function is added, thus making format configuration complex and making the physical format configuration very different vis-à-vis

DVD-ROM. Because of this, there is no mutual exchangeability in the physical format configuration between DVD-ROM and DVD-RAM, and regarding the address detection operation to read data etc, it is necessary that both be reproduced by an optical disk drive device that drives an optical disk side.

[0006]

This invention was done in view of the above situations, it is particularly suitable in handling large capacity data such as images and sound data, and the purpose is to provide the optical disk and an optical disk drive device that drives this optical disk wherein this optical disk uses rewrite type optical disk using MO (photo electro magnetic) medium and phase change medium etc or postscript (write once) type optical disk using pigment type medium that have the physical format that easily secures the mutual exchangeability with an optical disk specializing in reproduction.

[0007]

[Means to solve the topic]

In order to attain the above described objectives, the invention described in claim 1 is equipped with the characteristics wherein, regarding the optical disk such as rewrite type optical disk that is MO medium and phase change medium with spiral shaped track in order to record the information or reproduce recorded information, or the postscript type disks such as pigment type

medium, aforementioned track(s) is partitioned into multiple zones in the direction of radius of aforementioned optical disk, and the tracks used to record data is formed by wobbles with an optional fixed cycle that has different setting for each zone that were partitioned as described previously against the direction of radius of the aforementioned optical disk.

[0008]

Regarding the invention described in claim 2, the optical disk described in claim 1 has the characteristics wherein, at least in each zone, aforementioned wobbles are formed under the condition subjected to rotation control by the CAV (constant angular velocity) method and also it is formed such that the phase of aforementioned wobbles among the aforementioned adjoining tracks approximately match.

[0009]

and the invention described in claim 3 has the characteristics of being equipped with the drive means that drives by rotation the optical disk described in claim 1 or claim 2, rotation control means that controls the aforementioned drive means that enables the rotation of aforementioned optical disk by an optional fixed rotation number, frequency detection means that detects the frequency of wobble signals generated based on the wobble frequency formed by each zone of aforementioned optical disk, and address detection means that detects the address that specifies

the aforementioned zone based on the frequency of wobble signal that was detected by aforementioned frequency detection means.

[0010]

The invention described in the claim 4 has the characteristics of being equipped with the drive means that drives an optical disk described in claim 1 or claim 2 by the rotation, frequency detection means that detects the frequency of wobble signals generated based on the wobble cycle formed by each zone of aforementioned optical disk, rotation number detection means that detects the rotation number of aforementioned drive means, rotation control means that controls the aforementioned drive means to enable the synchronization of aforementioned optical disk with frequency of aforementioned wobble signals based on the detection output of aforementioned frequency detection means, and address detection means that detects the address that specifies the aforementioned zone based on the rotation number of drive means that was detected by aforementioned rotation Number detection means.

[0011]

The invention described in claim 5 has the characteristics wherein regarding the optical disk described in claim 1 or claim 2, at the time of recording data, in the recording area at the head of aforementioned each zone, address information that specifies the each zone is recorded.

[0012]

The invention described in claim 6 has the characteristics wherein regarding the optical disk described in one of the claim 1, 2 or 5, the minimum unit of file management of recording data has the physical format of aforementioned zone unit.

[0013]

[Embodied form of this invention]

Here below, the embodied forms of this invention will be explained in detail referring to the figures of the embodied forms. The configuration of this optical disk relating to the embodied form of this invention is shown in figure 1. In the figure, an optical disk 1 is rewrite type optical disk such as phase change medium or MO medium, or write once type optical disk such as pigment type medium. As the configuration of physical format of these rewrite type optical disk or write once type optical disk, track 2 is partitioned into multiple zone 21 ~ 2n in the radius direction of an optical disk 1.

[0014]

And, the track 2 that records data are formed snaking around in wave shape of an optional fixed cycle that has different settings for each zone that was partitioned as described previously vis-à-vis radius direction of an optical disk 1. Here in this specification, wobble frequency is the frequency that is detected from the information (wobble signals) that is obtained by the

wobbles of the different optional fixed frequency that are set up for each zone that are formed in the track and is generated at the time an optical disk 1 is driven to rotate by a fixed rotation number. As shown in figure 2, regarding the track that belongs to each zone $21 (Z1) \sim 2n(Zn)$, the wobble for each track is formed with a specified cycle in order that respectively different wobble frequency $F1 \sim Fn$ can be detected.

[0015]

Furthermore, Track 2 is not shown in the figure, but consists of convex group track (hereafter called group part) and concave land track (hereafter called land part) seen from the incoming direction of lights that is used for reproduction.

[0016]

And, at the time of forming wobbles in an optical disk 1, at least in each zone, wobble(s) are formed under the condition subjected to rotation control of an optical disk by CAV (constant angular velocity) method by an optical disk drive device, furthermore, and formed so that the phases of wobbles among the adjoining tracks approximately match. By configuring thus, since both land part and group part of tracks can always secure fixed track pitch, data are recorded in land part and group part, thus realizing the land/group recording.

[0017]

The configuration of an optical disk drive device relating to the

first embodied form of this invention is shown in figure 3. In the same figure, an optical disk drive device 10 is equipped with spindle motor 12 that drive the optical disk 1 by rotation, spindle motor rotation control part 14 that controls the rotation number of spindle motor, light head 16 that detects the wobble signals generated based on the wobbles that are recorded in the tracks of an optical disk 1, wobble frequency detection device 18 that detects the frequency (wobble frequency) of wobble signals that are detected by light head 16, and zone address detection part 20 that detects the address (hereafter called zone address) that specifies the zone from wobble frequency.

[0018]

zone address detection part 20 is equipped with memory part that stores the table showing the relationship between zone address showing each zone at an optical disk 1 and wobble frequency that is set up for each zone that are set up in advance, and based on the wobble frequency that were detected referring to the tables stored in this memory part, zone address is detected. For instance, in figure 2, above described table is obtained by replacing zone number into zone address.

[0019]

Here, the spindle motor 12 corresponds to the drive means of this invention; spindle motor rotation control part 14 to rotation control means of this invention; light head 16 and wobble

frequency detection device 18 to frequency detection means of this invention; zone address detection part 20 to address detection means respectively.

[0020]

In the above described configuration, spindle motor 12 drives by rotation the optical disk 1 under the control of spindle motor rotation control part 14. And spindle motor rotation control part 14 controls the spindle motor 12 in order to rotate the optical disk 1 with an optional fixed rotation number.

[0021]

as this result, an optical disk 1 is driven by rotation with an optional fixed rotation speed, and wobble signals are detected by light head 16 where said signals are generated based on the wobbles that are formed by different fixed cycle for each zone of an optical disk 1.

[0022]

Wobble frequency detection device 18 detects the wobble frequency from the wobble signals that were detected by light head 16. Zone address detection part 20 refers to the table that shows the relationship between the wobble frequency set up for each zone which is set up in advance and the zone address and, based on the wobble frequency that were detected from wobble frequency detection device 18, detects the zone address that specifies the zone where light head 16 is positioned.

[0023]

According to the optical disk drive device relating to the embodied form, tracks are partitioned into multiple zones in the direction of radius, and regarding the track that records data, spindle motor rotation control part 14 controls the spindle motor 12 for it to have an optional fixed rotation number wherein spindle motor 12 drives by rotation the optical disk 1 where tracks are formed by wobbles with an optional fixed cycle that has different setting for each zone that were partitioned as described previously, thus wobble frequency detection is enabled, hence, wobble frequency that are obtained from [illeg] wobble are different by each zone, hence, by detecting the wobble frequency, one can tell where current light head 16 is positioned in the zone of an optical disk 1

[0024]

Figure 4 shows the configuration of an optical disk drive device relating to the second embodied format of this invention. The difference of the configuration between the optical disk drive device relating to this embodied form and the optical disk drive device relating to the first embodied form are as follows: one is that spindle motor rotation control part 14 controls such that spindle motor 12 is rotated in synchrony with frequency of wobble signals, that is to say, wobble frequency, that is generated when an optical disk 1 is driven by rotation by wobbles formed

by the track of each zone of an optical disk 1, and the second one is that an optical disk drive device is equipped with rotation number detection device 30 that detects the rotation number of spindle motor 12, and memory parts that stores the table showing the relationship between rotation number of spindle motor 12 at the time of rotation in synchrony with wobble frequency, zone address detection means 32 is set up wherein based on the rotation number of spindle motor 12 that are detected by rotation number detector device 30, zone address is detected that specifies the zone where the light head 16 is positioned. Other configuration is identical, hence same symbols are used for the same elements, and duplicating explanation is omitted. Rotation number detection device 30 is comprised of for instance encoder etc.

[0025]

Regarding the above described configuration, an optical disk 1 is driven by rotation by spindle motor 12 under the control of spindle motor rotation control part 14. Wobble frequency detection device 18 detects the wobble frequency from wobble signals that were detected by light head 16. the spindle motor rotation control part 14 controls so that spindle motor 12 rotates in synchrony with the frequency of wobble signals generated at the rotation drive time of light disk 1 by wobbles

formed in each zone track of an optical disk 1, that is to say, the wobble frequency. As a result, the rotation number of spindle motor 12 that corresponds to one of the zone addresses is detected by the rotation number detection device 30 wherein said zone addresses were stored in advance in the memory part within the zone address detection part 32.

[0026]

zone address detection means 32 refers to the table that shows the relationship between the rotation number of spindle motor 12 at the rotation time in synchrony with the wobble frequency based on the rotation number of spindle motor 12 that were detected by rotation detection device 30 and the zone address of an optical disk 1, and detects the zone address that specifies the zone that has the position of light head 16.

[0027]

According to the optical disk drive device relating to this embodied form like this, rotation control of spindle motor 12 that drives the optical disk 1 by rotation is done in synchrony with wobble(s), and because the rotation number of spindle motor 12 that are detected for each zone of an optical disk 1 are different, by detecting the rotation number of spindle motor 12 by rotation detection device 30, the position of the current light head 16 in the zone of an optical disk 1 is found.

[0028]

That is to say, according to the above described each embodied forms, address information can be detected without forming the address information using prebits in light disk. As a result, it enables the improvement of utilization efficiently of format.

[0029]

And, at the time of recording data in above described optical disk 1, if the configuration is such that zone address information is recorded at each zone head together, at the zone where data has been recorded once, using the recorded zone address information, one can find out the position of zone of current light head 16. This condition is shown in figure 5.

Figure 5 shows the condition where ID part and data part (DATA) are set up wherein in the optical disk 1, zone address information for each zone by zone unit is recorded in ID part and data is recorded in data part. As can be seen from figure 5, it has the configuration similar to the physical format in the traditional common disks specializing in reproduction (ROM). As a result, using this invention, it enables to provide the optical disk with physical format that easily secures the mutual exchangeability with an optical disk specializing in reproduction.

[0030]

And, when data is recorded in the disk formatted like this, file management can be done by zone unit. In case a large capacity

data such as images and sound are handled, file management is facilitated, and it can be said that it is a quite effective formatting configuration.

[0031]

[The effects of this invention]

According to the invention described in claim 1, in the optical disks such as rewrite type optical disks that are MO medium or phase change medium equipped with spiral shaped track in order to reproduce recorded information and record information, or postscript type optical disk such as pigment type medium, it is designed such that aforementioned track is partitioned into multiple zones in the direction of radius of aforementioned optical disk, and the tracks that record data is formed by wobbles with optional fixed cycles that have different settings for each zone that were partitioned, as described previously, vis-à-vis direction of radius of aforementioned optical disk, hence, even if the address information is not preformatted, the information of zone position of current light head 16 in the optical disk can be found from the aforementioned wobble, and as a result, it is not necessary to reformat the address information as done in the past, the optical disk with high formatting utilization efficiency is enabled, thus realizing cost reduction.

[0032]

According to the invention described in claim 2, in the optical disk described in claim 1, it is designed such that at least in each zone, aforementioned wobbles are formed under the condition subjected to rotation control by CAV method (constant angular velocity), and, the phases of aforementioned wobbles among the aforementioned adjoining tracks approximately match, hence in all tracks, track pitch is formed in a fixed way, for instance, it can be applied for the system that records the data in both land part and group part of the tracks. According to the invention described in claim 3, it is designed such that the aforementioned optical disk is rotated with an optional fixed rotation number, and detects the frequency of wobble signals generated based on the wobble that is formed for aforementioned each zone, and according to the wobble frequency thus detected, zone address that specifies aforementioned zone is detected, hence, using fairly simple configuration, zone address information of an optical disk can be detected.

[0033]

According to the invention described in claim 4, it is designed so that aforementioned optical disk is rotated in synchrony with the aforementioned wobble frequency and by detecting the rotation number of an optical disk at this time, aforementioned zone address is detected, hence, using fairly simple configuration, zone address information of an optical disk can be detected.

[0034]

according to the invention described in claim 5, at the time of recording data, it is designed so that zone address information is recorded together at each zone head, hence, in the zone where data was recorded once, by reproducing the address information of zone recorded at the head of each zone, the position of current light head 16 can be found.

[0035]

In Claim 6, it is designed so that the minimum unit of file management of recording data is made to be the aforementioned zone unit; hence, this realizes a fairly simple file management system.

This enables to provide the optical disk. format highly suitable for system to handle a large capacity data, particularly, images and sound data.

[0036]

As described above, using this invention, we can provide physical format of an optical disk suitable for large capacity.

[Simple explanations of drawings]

[Figure 1]

An explanation drawing showing the configuration of an optical disk relating to the embodied form of this invention

[Figure 2]

A table showing the relationship between the zone number that specifies each zone of an optical disk in figure 1 and wobble frequency that is set up in each zone

[Figure 3]

A block diagram showing the configuration of an optical disk drive device relating to the first embodied form of this invention that drives the optical disk shown in figure 1

[Figure 4]

A block diagram showing the configuration of an optical disk drive device relating to the second embodied form of this invention that drives the optical disk shown in figure 1

[Figure 5]

An explanation drawing showing one example of physical format of the optical disk relating to the embodied form of this invention

[Figure 6]

An explanation drawing showing the configuration of traditional reproducing type of an optical disk

[Figure 7]

An Explanation diagram showing the physical format specializing in reproduction type of an optical disk shown in figure 6

[Explanation of symbols]

1 An optical disk

10 An optical disk drive device

12 spindle motor

- 14 spindle motor rotation drive part
- 16 light head
- 18 wobble frequency detection device
- 20 zone address detection part
- 30 rotation number detection device
- 32 zone address detection part

[Figure 1]

wobbled tracks

[Figure 2]

Zone number	Wobble setting frequency

[Figure 5]

Zone n-1 zone n zone n+1

[Figure 6]

50: an optical disk

52: data recording [illeg]

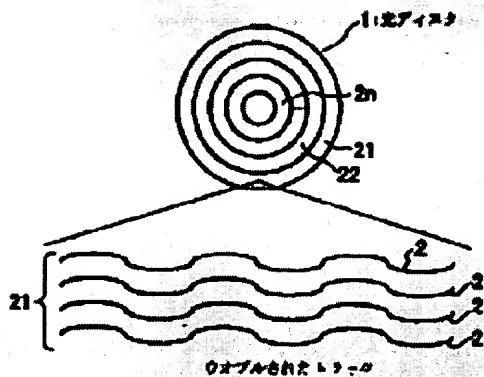
[Figure 7]

1 frame

(Sector)

Frame Fn-2 frame fn-1 frame fn frame n+1

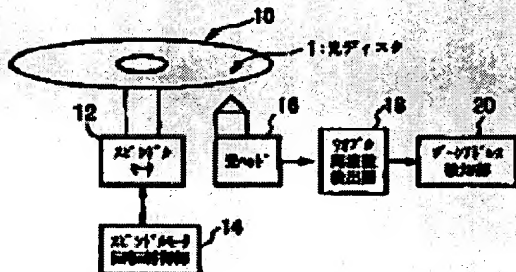
【図1】



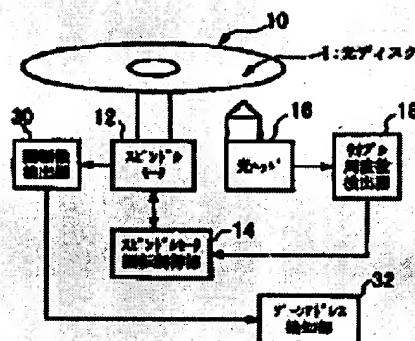
【図2】

ゾーンナンバー	ウォブル幅と周波数
Z1	P1
Z2	P2
Z3	P3
...	...
Zn	Pn

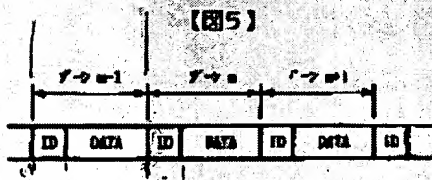
【図3】



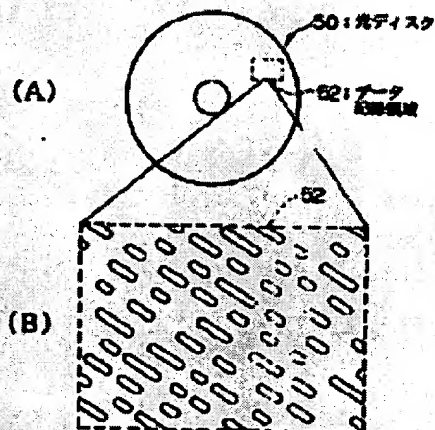
【図4】



【図5】



【図6】



【図7】



/1¹

¹ Numbers in the margin indicate pagination in the foreign text.